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CRITERIA FOR THE THEORETICAL ADEQUACY OF CONCEPTUAL FRAMEWORK OF PLANNED EDUCATIONAL CHANGE.

BY- BROUDY, HARRY S.

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THE CURRENT INADEQUACY OF A CONCEPTUAL FRAMEWORK ALLOWING ACCUMULATION AND SYNTHESIS OF KNOWLEDGE CONCERNING EDUCATIONAL CHANGE IS EVALUATED. CONSIDERATION OF EDUCATIONAL CHANGE AS SCIENTIFIC KNOWLEDGE PRESUPPOSES EXPLORATION OF THE DIFFICULTIES THAT RESTRICT THE MEETING OF THE ACCEPTED SCIENTIFIC CRITERIA OF DESCRIPTION, EXPLANATION, PREDICTION, AND CONTROL AS WELL AS THE SCIENTIFIC METHODOLOGICAL REQUIREMENTS OF OBJECTIVITY AND SKEPTICISM. WITHIN AN ESTABLISHED BODY OF SCIENTIFIC KNOWLEDGE A STRUCTURE OF PHENOMENA IN LOGICAL RELATIONS AND A METHODOLOGY MADE UP OF DEFINITE RULES OF PROCEDURE CAN BE DISCERNED. WITHOUT A STRUCTURE OF RELATIONS AND PROCEDURAL METHODOLOGY, INQUIRIES MAY OR MAY NOT LINK UP WITH EACH OTHER AND RESULT IN AN ACCUMULATION OF FINDINGS RATHER THAN A CUMULATION OF RESULTS. AN INADEQUACY OF THIS NATURE IS CHARACTERISTIC OF KNOWLEDGE CONCERNING EDUCATIONAL CHANGE. WITHOUT CONSENSUS UPON THE CONCEPTUAL FRAMEWORK OF RELATIONAL AND METHODOLOGICAL FACTS, IT IS DIFFICULT TO FORMULATE THEORIES THAT SYNTHESIZE LARGE AREAS OF WELL-ESTABLISHED FACT. THE ATTEMPT TO MAKE A SCIENCE OUT OF ANY SOCIAL PHENOMENA IS CONSTANTLY QUESTIONED BECAUSE OF THE INHERENT SUBJECTIVITY OF THE SOCIAL SCIENCES, THE VALUE FACTORS OF BOTH INVESTIGATOR AND INVESTIGATED PHENOMENA, AND THE COMPLEXITY OF GROUP DYNAMICS. A CONCEPTUAL FRAMEWORK FOR EDUCATIONAL CHANGE SHOULD TAKE INTO CONSIDERATION THESE INHERENT DIFFICULTIES OF PSYCHOLOGICAL AND SOCIAL PHENOMENA ANALYSIS. ITS SCIENTIFIC STUDY COULD PROCEED ALONG THE TWO LINES--(1) AN EXTRAPOLATION OF EXISTING TRENDS IN SOCIAL SUBSYSTEMS AND A SPECULATION OF CONSEQUENCES, AND (2) AN EMPHASIS ON CRITICISM OF WHAT HAS BEEN DISCOVERED, INCLUDING AN EXAMINATION OF CONSISTENCY, EMPIRICAL CONSEQUENCES, AND ATTEMPTS AT FALSIFICATION. (GB)

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CRITERIA FOR THE THEORETICAL ADEQUACY OF CONCEPTUAL FRAMEWORK OF PLANNED EDUCATIONAL CHANGE

Harry S. Broudy University of Illinois

The general problem to which this conference is directed is summed up in the question: How do we accelerate planned change in education? This is a problem because, according to the project proposal, educators have insufficient detailed knowledge about how change takes place. Furthermore, it is asserted that many educators have objections to planned change in principle.

With regard to the first point, it is argued that knowledge is accumulating both in the educational literature but more especially in rural sociology. It is with the criteria for the theoretical adequacy of the conceptual framework of this knowledge that this paper is directly concerned. I am not sure just what is to be done about the alleged inbuilt resistance to planned change among educators, but on a point somewhat related to it a few comments will be made in the course of these preliminary remarks.

A system of scientific knowledge enables us to describe, explain, predict, and possibly control events within a given domain of phenomena. What would it take to achieve such knowledge about educational change? Obviously, if educational change were a department of physics, chemistry, or even biology there would be no special problem of theoretical criteria; these are well known, and controversies about them are abstruse affairs left to the philosophers of science. However, educational change, social change in general, and indeed all the subjects matters dealt with in the social sciences are not departments of physics and chemistry (at least not yet), and it is not always clear as to how or even whether one can satisfy the criteria that are taken for granted in the natural sciences.

I take it, therefore, that part of my task is to explore the difficulties that lie in the way of meeting the criteria of generalization, explanation, prediction, and control as well as the requirements of scientific method with regard to objectivity, open-mindedness, faith in the quest for knowledge, and skepticism about every candidate for that honor.

The conference proposal does not make it clear at what level the planners of educational change are expected to justify the changes they propose, and whether the strategy of producing change itself has to conform to some moral norm. Suppose a theory of educational change runs something like this: Educational administrators accelerate change within their systems on the basis of what

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they believe will enhance their prestige. They believe what subconsciously they would like to be the case. Change within the system is therefore brought about most efficiently when the proposed change is presented as appealing to their repressed desires. Is this theory or its conceptual framework theoretically adequate? It might turn out to be if, for example, one could successfully predict change states from the theory. Morally, however, the theory would be somewhat less than adequate, and in some societies this would render it useless; the predictions would not be successful. We have an analogous situation in that we know what would kill certain viruses within the human organism but the agent that would accomplish the death of the virus would also bring about the death of the patient. A theory that assumed the use of this virus killer would cure the patient would be falsified forthwith. Or suppose that some one comes up with a theory that says social changes come about only through the shifts of power, and that to plan change is to plan such power transformations. To educational administrators committed to democratic methods of social change, such a theory might be so unacceptable as to render them hostile to any such planning; a Machiavellian school master might have no such scruples.

Furthermore, changes in the educational system range from those that are fairly local to those that are pervasive; from those that leave the value schema of the system intact to those that disrupt it. Changes from the use of blackboards to greenboards is an example of the former; a change from careful and strict grading to no grading at all is an example of the latter. Local changes are rarely value disruptive, but some pervasive changes may not be either, for example, the color of the boards.

The import of this distinction is epitomized in the following query: Can value commitments and changes in them be studied scientifically? If the answer is in the negative, criteria will be of at least two sorts: those governing the search for empirical truths about educational change, and those that measure the worth of the changes in themselves. If, however, the answer is in the affirmative, then the same criteria can serve to check the adequacy of statements about value as well as fact.

This is not the place to argue the merits of an affirmative or negative answer, but I take it that the criteria sought for in this project are for inquiries that purport to give warranted assertions in the manner of empirical science. To the extent that such inquiries can give answers to value questions--and at some levels they seem to be able to do so--they need not evade the

value components that inhere in problems of educational change.[1]

It will be helpful in reading the material which follows to refer to Figure 1.

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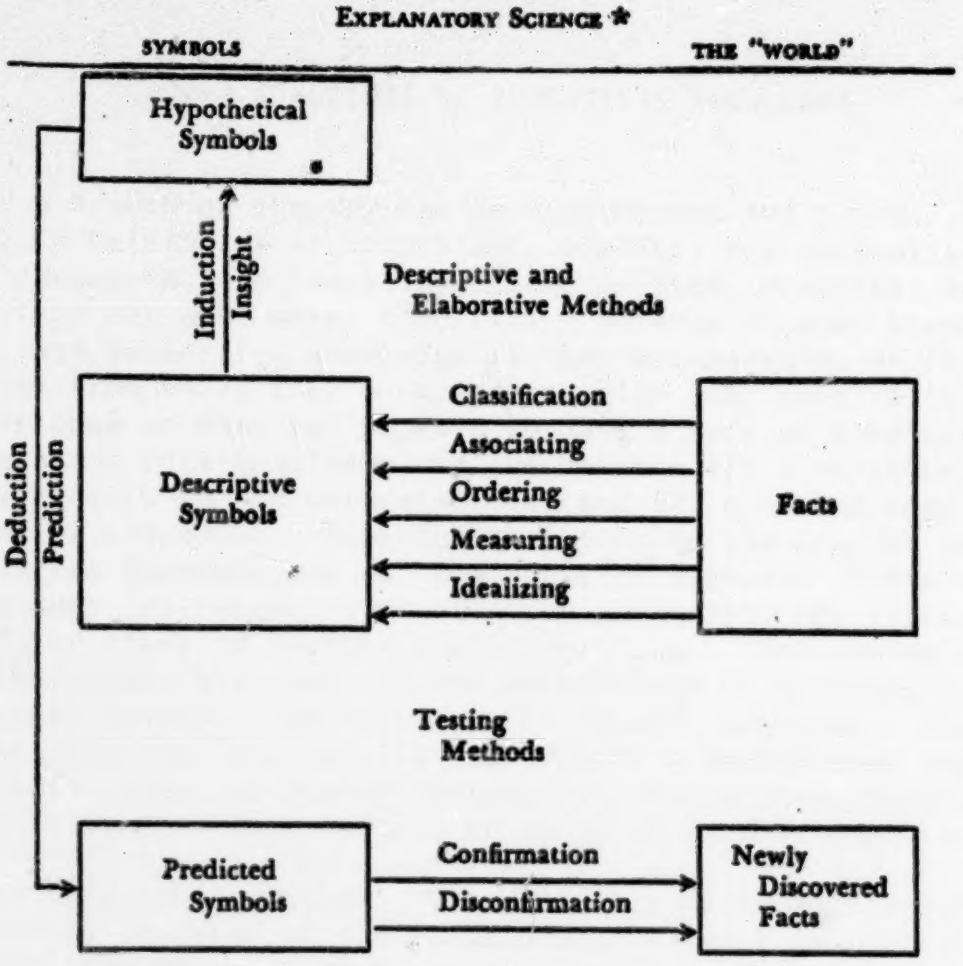
[1]I happen to believe that the ultimate justification of value claims lies in a theory of human nature that has metaphysical as well as empirical dimensions. To this extent I do not believe that any purely "scientific" theory of educational change will be sufficient to determine strategy if ultimate value commitments are called into question.

FIGURE 1

EXPLANATORY SCIENCE *



*Taken from A. Cornelius Benjamin, Science, Technology and Human Values, Columbia, Mo.: Missouri University Press, 1965, p. 133 (Permission for publication not yet applied for).

I. THE STRUCTURE OF SCIENTIFIC KNOWLEDGE

After a branch of inquiry has been developed and proved itself successful in helping us to understand, predict, and control a certain domain of phenomena, one can study its activities, products, and agents to find out what makes them tick. Science is what these agents do, and scientific knowledge is that accumulation of facts and theories from which they work and to which they contribute. A well-developed science can be said to have a body of knowledge and by analyzing this knowledge one can discern (1) a structure made up of constituents in logical relations, and (2) a methodology made up of rules of procedure. Together they provide the logical criteria for theoretical adequacy and for the style of inquiry. These two are related in that (a) in empirical sciences, at least, the logical criteria call for clues to testing procedures, i.e., for making experimental methods possible, and (b) the methodology of a prosperous science itself becomes a warrant for the results achieved. Thus we rule out as unscientific, results achieved by a method that scientists do not approve, e.g., divine or terrestrial revelations, hunches of all kinds, intuitions and insights if not confirmed by empirical tests.

Accordingly, the question: "Is X a piece of scientific knowledge?" can be answered in terms of the structure of which X is a logical component or by the way in which X was arrived at, and preferably, both.

Facts, laws, generalizations

There are many ways of analyzing a body of scientific knowledge and the one I shall sketch makes no claims to completeness or technical subtlety. First of all, we find statements that describe recurring states of affairs. These are sometimes called facts, sometime empirical generalizations, sometimes scientific laws. Psychologically and in ordinary usage these different terms connote somewhat different degrees of importance and assuredness: a fact, for example, is regarded as given, brute, hard to change, independent of our wishes, true. This meaning is apt for the singular statement that describes a state of affairs unique in space and time, particular events, such as are reported by "The sky is now blue" or "John has a mole on the right side of his cheek." More often facts are generalizations about what a class of objects or events are or do. Thus we say that it is fact that water (under standard conditions) boils at 100 degrees C., but we do not mean thereby any particular potful of water on any particular stove.

A "law" sounds more impressive and dignified than a fact,

primarily because we usually mean by it a law of nature rather than a less important generalization. "All cats like fish" is a generalization, and so is the statement that "Water boils at 100°C," but we would not call the first a law, whereas the latter is often so regarded. On the other hand, fact has the connotation of truth, so that any statement, if it withstands refutation long enough, comes to be regarded as a fact. Thus although the notion that a potful of boiling water is a whirling mass of molecules is not something we can observe, the scientific community is likely to regard this hypothesis as a fact.

Of course, all generalizations arise at one time or another out of the experience of some individual at a particular time, and presumably a good deal of human experience went over the dam before man began noticing that certain experiences recurred. And in the last analysis no scientific theory, however subtle and abstract, can dispense entirely with some individual having an individual experience such as seeing a pointer move across a line, or a squiggle on a screen. Yet the scientific aspect of experience does not really begin until generalization sets in.

These descriptions of recurring states of affairs can take several forms: (a) Descriptions of invariable conjunctions of properties, e.g., the temperatures at which liquids boil or substances melt or freeze. (b) General descriptions of sequences of events or processes, e.g., a scarcity of goods is followed by inflation which is followed by lack of confidence which is followed by a fall in production and investment, etc., etc. (c) Descriptions of correlations or covariations between events or properties, e.g., scores on mental tests vary with the class membership of pupils.

These descriptions are of varying degrees of generality. Boyle's law describing the relationships among the volume, temperature, and pressure of gases is more general than the law describing the boiling point of water, but what purports to be a description (a theory of how molecules behave under variations of temperature and pressure) is more general than either. Generality can have another meaning, somewhat less important for scientific knowledge. A statement is more general than another if the second can be subsumed under the first, but not the first under the second.[2] A third meaning identifies generality with the size of the extension of the term. Thus generalizations about water are applicable to more instances than those about diamonds. However, this last use is more indicative of the usefulness of a generalization than of its logical power.

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[2]For a precise and detailed discussion, see Ernest Nagel, The Structure of Science, New York: Harcourt, Brace & World, 1961, pp. 37ff.

Scientific statements whatever their degree of generality strive to express invariance in the form of uniformities of nature or laws of nature. Only by noting the regularities in phenomena can we understand and control them. If there are exceptions, they must also be explained in terms of regularities. Individual occurences are scientifically insignificant except as clues to regularities, variations as clues to invarience. Here science and art differ diametrically, for in art the end produced is highly individual, and regularities are used as instruments to achieve aesthetic effects. The significance of a scientific discovery never lies in the event that occasioned it. The particular apple was insignificant so far as Newton's discovery was concerned; any apple would have done as well.

Another characteristic of scientific generalizations is that they must be more than enumerations, i.e., go beyond all examined instances. "Water boils at..." is supposed to cover all appropriate cases whether observed or not, past, present, and future. Statements which cover all the examined cases are, properly speaking, reports of individual states of affairs spread out over spans of time or regions of space. Thus a survey of the salary schedules of all the school systems in a county is not a generalization but a report. It is a fact in the sense of summarizing a specific state of affairs.

Once a statement goes beyond the observed cases it becomes vulnerable to logical questions such as : "On what grounds do you leap from what you have observed to the unobserved?" thereby opening up the whole problem of induction and its justification. We shall see that in the social sciences invariance is the hardest criterion to meet. Statements beginning with "All" in the social sciences are usually false or trivial; they become rarer and rarer as social scientists become more cautions, i.e., more scientific in their methods. This may not be a fatal flaw in social science, but to invoke an old cliche, it is like building a skyscraper on pilings that float in loose sands of varying density. It can be done, but it is not easy. But I shall return to this point.

Hypotheses and theories

At a still higher level of generality a body of scientific knolwedge contains statements of sets of statements that are variously called hypotheses or theories. These often have the form of descriptions in that they purport, if proved adequate, to be descriptions of how matters stand in nature. Two features, however, distinguish them from the kinds of empirical generalizations we have been describing. For one thing (a) they can be used to <u>explain</u> the descriptions we have called facts, and laws and (b) they <u>contain</u>

or can contain elements that are not themselves items of observation. These are often called constructs: atoms, electrons, repressed desires are all constructs invented by a theorist to explain facts that are observable and laws that, although not observable themselves, are inferred from observables. Thus "Water boils at 100 degrees C." is not observable as such; only particular volumes of water are observed in the boiling.

A highly developed theory such as is found in modern physics or chemistry will have as constituents (1) a set of notions or ideas or constructs (for example, molecules, electrons, atoms, orbits) that have the properties needed by the theory to account for the phenomena to be explained.

(2) A set of rules (operational definitions, coordinating definitions, semantic rules, epistemic correlations, rules of interpretation, etc.) that enable us to translate the basic notions and their relations into empirical procedures. Thus, according to Nagel, Niels Bohr related the theoretical notion of a jump of an electron from one orbit to another to the experimental notion of a line on the spectrum. Galileo translated notions of acceleration, gravity, etc., into experiments with leaning towers, balls, etc.

(3) Some mode of interpreting the theoretical notion in more concrete terms. These are usually referred to as models.

Although not every item in the theory will be linked with some experimental procedure by a correspondence rule, enough items must be to permit experimental testing.[2a]

To what extent theories in the social sciences can come up to these requirements will be discussed later.

Explanation and prediction

A good theory, we are told, explains laws, facts and "it predicts and explains in advance laws which were unknown before."[3]

The philosophers of science have produced a vast literature on this topic, but for our purpose only enough will be presented to indicate

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[2a]Nagel, op. cit, pp. 90ff. provided the basis for this classification.

[3]Norman Campbell, What is Science? New York: Dover Publications, Inc., 1952, p. 87.

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the kind of distinctions we have to keep in mind when assaying the conceptual framework in which the problem of studying educational change is concerned.

Nagel distinguished four types of explanation:[4]

1. Deductive What is to be explained is shown to follow from or be implied by the theory. Thus if one asks why dreams are so strange and disconnected, we might explain as follows:

Whatever threatens the personality is kept in the unconscious (repressed).
A repressed desire, to get into consciousness, must be disguised (scrambled).
A dream is a disguised repressed desire.
Therefore, a dream is always scrambled. or
If a repressed desire is to get into consciousness, it must be disguised (scrambled).
A dream is a repressed desire trying to get into consciousness.
Therefore a dream is scrambled (disguised).

Of course, the first premise is a highly compressed version of the total theory, but from it flows the consequence that dreams in general are scrambled, and that any particular dream will be also.[5]

2. Probabilistic The premises contain a statistical assumption (or assertion) about some class of elements while the thing to be explained is a singular statement about a member of that class. Why is this child, and that child, and that child failing in school?

We explain as follows: Most children who do well in school are good in language skills. Most culturally deprived children are not good in language skills. These particular children are culturally-deprived. Therefore, these children do poorly in school.

The possibility is left open that some children who do well in school are not good in language skills, that some children who are culturally deprived are, and that some culturally deprived children are good in school. The trouble, of course, is that we cannot predict

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[4]Nagel, op.cit, pp. 20-26.

[5]Note how this theory shapes up with the three constituents listed above. It has the constructs or basic notions required to permit deduction of the phenomena, and one could easily devise diagrams and models that would incorporate the key notions. But whether it has provided transformation rules for experimental procedures is still open to question, especially experiments that could lead to the falsification of the theory.

which individual children will be the exceptions to the "most" statements, even though we might predict with a specific degree of confidence that for appropriate samples the generalizations will hold.

3. Functional or teleological These explanations explain by indicating the function or dysfunction that a unit performs in a system of which it is part. Thus we explain the structure of the heart by showing what the heart does in maintaining circulation of the blood; or, as in the teleological explanation, we explain John's presence at the airport by his intent to fly to New York.

4. Genetic We set out the sequence of major events through which some earlier state of affairs is transformed into a later one. If one asks why schools have commencements in June and begin school in September, the explanation involves recounting those features of the agrarian economy that made these states of affairs fit into the sequence. Genetic explanations are complex matters, for only those events that are judged to have some part in causing the result are selected. But what guides us in choosing the events? Presumably we are guided by some generalizations about regularities in the behaviors of farm people and school establishments. Clearly these generalizations are in all probability themselves only probable, so genetic explanations are less innocent than one might expect a simple narration of events to be.

The view that explanation is no more than showing that X is an instance of a higher law is not universally accepted. Norman Campbell, for example, "dissent(s) altogether from this opinion."[6] For one thing, he distinguishes laws from theories. Thus Boyle's law and Gay-Lussac's Laws state generalizations about the behavior of gases, but the Dynamical Theory of Gases explains them.[7]

Campbell goes on to say that laws can be deduced from a theory, but this is only logically necessary and not sufficient for explanation.

"What else do we require? I think the best answer we can give is that, in order that a theory explain, we require it--to explain! We require that it shall add to our ideas, and that the ideas which it adds are acceptable."[8]

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[6] Op. cit., p. 80.

[7] Ibid., p. 81.

[8] Ibid., p. 83.

Models

It is for this reason perhaps that models are used to increase the apprehension of a theory. A model interprets a theory by translating it into a machine, a diagram or some other set of entitites that are more familiar than the theory itself. For example, in trying to account for social change we might theorize that change is a function of the conflict between the Freudian id, ego, and superego. To make the conflict more easily imaginable, we might construct a diagram with arrows representing the three forces and their directions, and if we postulated that somehow this little system would always remain in equilibrium or try to restore it, we might imagine how a push by the id would elicit a counter move by the ego and superego. Another model for an equilibrium system might be a system of pipes in which the liquid shifts as pressures are varied.

In this connection it might be noted that when we make models of human behavior we are tempted to make a theory out of the model rather than vice versa. Thus, because computers are based on what goes on in human thinking, it is easy to think of the human mind as a computer. Much of the theorizing on social change is, one might guess, more a model building venture than that of developing theory. This does not mean that such model building may not be suggestive and set off a creative process that will result in a system of ideas that will explain a wide variety of facts about social change.[9]

Another important criterion of a good law is brought out by Campbell when he says:

> So far the truth of a theory has been based on two grounds: first, that the laws to be explained can be deduced from it; second, that it really explains in the sense that has been indicated (reduces the unfamiliar to the more familiar and therefore more intelligible). But actually there is in addition, a third test of the truth of a theory, which is of great importance; a true theory will not only explain adequately the laws that it was introduced to explain; it will also predict and explain in advance laws which were unknown before. All the chief theories of science (or at least in physics) have satisfied this test; they

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[9]F. A. Hayek, The Counter-Revolution of Science, (Glencoe, Ill.: The Free Press, 1955, p. 57) holds that in social science one does not deal with given wholes, but that one has to "constitute these wholes by constructing models from the familiar elements--models which reproduce the structure of relationships between some of the many phenomena which we always simultaneously observe in real life." Examples of such models might be the economic market with its products, buyers, and sellers.

> have all led directly to the discovery of new laws which were unsuspected before the theory was proposed.[10]

Prediction in this sense is allied with the theoretical fruitfulness of a theory. Prediction is also used to refer to the possibility of foretelling what consequences the theory might have that could be tested experimentally. Further, prediction means foretelling the course of events so that one can control them. The three senses are related, although, of course, prediction does not insure control, e.g., we can predict eclipses of the sun but we cannot control them.

Perhaps the important requirement implied by the aforegoing criteria of theories is that they have within them the ideas that have captured some pervasive character of reality--a character that phenomena other than the problem under investigation possesses. That a theory accounts for the given problem is only a beginning; if it cannot be extended to different problems, it is scientifically trivial, ad hoc. In the social sciences this criterion is especially important because it is so easy to stop with ad hoc explanations. That is a good reason for encouraging criticism of theories as soon as possible.

It takes a genius to invent great theories. Campbell speaking of Newton said:

> And then the apple fell from the tree.....The idea flashed on him quicker than it could be spoken. If both the moon and the apple are pulled toward the earth, may they not be pulled by the same force? May not the force that makes the apple "fall" be that which restrains the moon in its orbit?[11]

Lesser and more numerous minds can do the criticism and testing, including appreciative criticism which in its higher reaches is itself a creative act.

I have run through the standard discussions of the structure of a body of scientific knowledge, because there is no other way of indicating the criteria for an ideal system of knowledge. Some of the natural sciences approximate it and all sciences aspire to it, including those inquiries that concern themselves with human behaviors occurring in individuals and in groups.

Whether an inquiry succeeds depends on the style of the inquiry,

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[10] Op. cit. p. 87.

[11] Op. cit, p. 101

the nature of the subject matter, and on the devotion of the investigator to the problem. The style of the inquiry is usually referred to as "scientific method" and stresses objectivity on the part of the inquirer, the replicability of the procedures used, the adherence to the ideal of testability, and simple honesty on the part of the reporter. Other criteria that are often mentioned include consistency with well-established theory and well-established facts within the field of inquiry; simplicity and parsimony. Some of these criteria are logical; some are methodological, but the degree to which they can be satisfied also depends on the state of the field itself. For example, suppose one asks whether a theory or a finding is in accordance with well-established fact or theory. This makes sense in physics and chemistry where workers in the field agree pretty well as to what is well established and what is not. But suppose one asks this kind of question in sociology or anthropology or economics.

Accordingly we shall now turn to the possibility and difficulty of approximating the ideal conditions in the social sciences.

II. THEORETICAL CRITERIA AND THE SOCIAL SCIENCES

There seems to be no generally agreed upon set of established facts in the field of educational change and indeed in the social sciences as a whole:

> It is also generally acknowledged that in the social sciences there is nothing quite like the almost complete unanimity commonly found among competent workers in the natural sciences as to what are matters of established fact, what are reasonably satisfactory explanations (if any) for the assumed facts, and what are some of the valid procedures in sound inquiry. Disagreement on such questions undoubtedly occurs in the natural sciences as well. But it is usually found at the advancing frontiers of knowledge...[12]

In their inventory of scientific findings in the behavioral sciences Berelson and Steiner quote from Ernest Hilgard to the effect that:

> the state (of factual knowledge) is not very satisfactory; neither is it very easy to remedy. The number of dependable "facts" in the various fields of psychology are not very impressive.[13]

Edward Shils is quoted as saying:

> nothing is more necessary at present than the systematic collation and "shaking down" of American sociological research results to discover what they amount to, to weigh evidence on crucial problems and to see what is really known on the basis of adequate evidence and what is still unsettled.[14]

I cite these remarks not to point a derisive finger at the social sciences but rather to bring home the point that without a solid backlog of established fact and theory inquiries perforce are instituted from a thousand viewpoints that may or may not link up with each other. This results in an accumulation of "findings" but no cumulation of results. There is then a kind of sociological criterion for theoretical adequacy of a conceptual framework, as well as logical and methodological ones. I mean by this term the state of a field of inquiry with respect to its state of maturity. This is an important factor because

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[12]Ernest Nagel, The Structure of Science, p. 448.

[13]Bernard Berelson and Gary A. Steiner, Human Behavior, New York: Harcourt, Brace, & World, 1964, p. 4. Quoted from "The Present Status and Prospects of Psychology as a Science and as a Profession." Unpublished mss. 1957, p. 7.

[14]Ibid., quoted from The Present State of American Sociology, Glencoe, Ill.: The Free Press, 1948, p. 43, in Berelson and Steiner, op. cit.

some of the criteria for scientific knowledge become inapplicable until a sufficient state of maturity is reached.

The Methodological Circle

We seem to be caught in a vicious methodological circle. Without some consensus as to the well-established facts in the field of inquiry it is difficult to formulate or discover important theories that unify large domains of well-established fact. Yet, without some established theories, researchers have no guide as to what are the important facts--important in the sense of being fruitful for further development of knowledge. Consequently, until a field does reach a degree of consensus as to its important problems neither theory-building nor fact-gathering can progress except by sheer accretion of happy accident or the ingression of a genius.

What has been said about making positive additions and refinements to knowledge in the social sciences also applies to the business of clearing the field of lame duck theories and schemes that could not stand rigorous testing either on logical or experimental grounds. The quickest way to drive a theory into doubtful repute is to show its inconsistency with established fact or theory. But when no such bench-lines are available the field remains cluttered with approaches and models and classifications.

For example, there is no single scheme of classifying human motives although it is one of the important concepts in the behavioral sciences. One classification that is widely used in current research lists 28 psychogenic needs.[15]

According to Robert Chin[16] the systems model of change utilizes the following major terms: System, boundary, energy interchange, tension, stress, strain, conflict, equilibrium, steady state, and feedback. Developmental models utilize the notion of direction as defined by goals, or by the process of developing or maturing or movement toward some goal. The term "identifiable state" involves such other terms such as "stages," "states," "phases," and "periods." Chin notes that, "No uniformity exists in the definition and operational identification of such successive stages."[17] Also used are terms denoting forms of progression and forces and potentiality.

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[15]H. A. Murray, ed., Explorations in Personality: A Clinical Experimental Study of Fifty Men of College Age, New York: Oxford University Press, 1938, p. 80-83

[16]The Planning of Change, Warren G. Bennis, Kenneth D. Benne, and Robert Chin, eds. New York: Holt, Rinehart, & Winston, 1961, pp. 201-214.

[17]Ibid., p. 209

A third model for change "incorporates some elements of analysis from the system models, along with some ideas from the developmental model, in a framework where direct attention is paid to the induced forces producing change. It studies stability in order to unfreeze and move some parts of the system"[18] The direction of the change is left to the choice of the client-system.

The variety of models used to structure social change itself promotes wide variation in the ideas selected for basic theoretical units. The research consequently also becomes highly diversified in terminology and styles of conceptualization.

This diversity is almost inevitable if we realize how difficult it is to utilize the principle of the ideal case[19] so useful in natural science. Lines without width, inclined planes without friction, falling bodies in vacuo--these ideal situations furnished concepts that bore fruit in the natural sciences. But in educational change, the resistance to change, for example, unlike the friction on the inclined plane, may be the important variable. A definition that ignored it would become not only practically useless but theoretically inadequate.

Accordingly, the terms or concepts, the basic units of educational change tend to take a form that enables us to identify them in ordinary experience. The terms "need," "role," "goal" are labels put on bins that contain a wide variety of items. Needs, for example, are physiological and psychological; conscious and unconscious; real or imagined; individual or social. Even if we were successful in reducing the terminology of human behavior to reflexes or the chemical combinations of elements, there would still remain the problem of the "human" considerations mentioned earlier. In other words, if in principle individuality must count heavily in social changes, then theories based on the complete abstraction from individuality are "false." There is some real doubt that we can refine our terms too much and still retain the problems of social change in recognizable form.[20]

Much of the research in the social sciences has gone into showing that certain common sense generalizations can be firmed up by the proper scientific methodology. Consider, for example, the following generalization or finding: When a person is frustrated the barrier may be attacked physically or symbolically...or if actual attack is impossible aggression may be displaced to an innocent but more vulnerable bystander.[21] Or as another example of sound common sense expressed formally consider this statement:

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[18] Ibid., pp. 213-214

[19] Nagel, op. cit, pp. 505ff.

[20] Nagel, op. cit, p. 508

[21] Berelson and Steiner, op. cit, p. 267

> A period of innovation and change affecting an organization is likely to produce a heightened amount of communication among the members, communication oriented both toward the task and toward mutual emotional support.[22]

We are told that strong informal groups within an organization, when hostile to its goals and methods, can effectively oppose the organization and that there is always a tendency for organizations (of a nonprofit character), at least partially, to turn away from their original goals.[22a]

The "always" in the preceding passage promises a useful degree of generality, but this is immediately dampened by the "at least partially" that follows. Later one reads that although "typically it occurs through putting means in the place of ends, procedures in the place of goals," there are at least a half dozen possible causes. The upshot of the finding is that it covers a wide variety of goal-displacement, and about all one can do with this statement is to be on the alert for some kind of displacement if the organization in question has been around for some time. Yet some assumptions about the dynamic relations between original and displaced goals may be an important factor in explaining change in organizations.

We have already noted how difficult it is to get away from the common sense guide to problems in the social sciences, and the elaborate establishment of the obvious may be a necessary stage in the development of knowledge about human behavior. However, this may be more than the awkwardness due to the youth of the science. Now it might be possible to explain all human behavior in terms of chemical reactions, but these explanations will lack any interest for us save as use of chemicals might help to control it. The biological regularities of hormone secretion are of great theoretical interest to the biologist, but love phenomenologically is not hormones. Until we can find a hormoneal description of what it means to be in love with X rather than with Y and the hormonal state that produces happy families rather than divorces, the social scientist had better stick to those molar behaviors that are

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[22] Ibid., p. 370

[22a] Ibid., p. 366

distinctively human.[23]

Some Objections

Can the social sciences hope to meet the logical and methodological criteria of scientific inquiry. I shall try to indicate some of the major difficulties and some possible rejoinders.[24]

Nagel raises the question as to why the social sciences have not come up with laws, generalizations, and theories that can compare with those in the physical sciences.

One cluster of reasons includes the following:

1. They cannot make rigorously controlled experiments.
2. They cannot meet the requirement of varying only one factor at a time.
3. They cannot make predictions because the factors with which they deal are in constant flux.
4. The act of inquiry affects the results of the inquiry by (a) self-verifying prophecies or (b) by suicidal predictions.

The general answer that Nagel makes is that the natural sciences have not always been able to meet some of these requirements (e.g., astronomy and geology have not been able to make controlled experiments) and that the difficulties are not fatal.

Nagel is of the opinion that with the aid of techniques of quantitative analysis some of

[23]It is interesting to consider what would happen to the human problem of divorce if it could be established that it was due to hormonal imbalance that could be diagnosed and corrected. All the current causes of divorce would then be explicable by hormonal distributions in the partners. The divorce problem would then be reduced the the problem of getting couples to undergo diagnosis and treatment, just as birth control is now a problem of implementing what can be accomplished. So we would transform divorce into a problem of attitude towards adopting the rational solution (which is chemical). Suppose now that failure or willingness to adopt the correct attitude is shown to be reducible to the amount of chemical Y in the blood stream. Everything now depends on willingness to undergo the treatment for the blood, and here we reach an impasse unless we seize the subject and inject Y into his bloodstream.

[24]Much of what follows is indebted to Ernest Nagel's Chapters 13 and 14 in his The Structure of Science. Page references unless otherwise indicated will refer to this material. However, the treatment in this paper is not to be taken as a transcription or summary of Nagel's views.

> the relations of dependence between components in various social processes have been made evident and have thereby supplied more or less firmly grounded generalized assumptions for explaining many features of social life, as well as for constructing frequently effective social policy. To be sure, the laws of generalizations are far more restricted in scope of application, are formulated far less precisely... than are most of the commonly cited laws of the physical sciences...In these respects, however, the generalizations of social inquiry do not appear to differ radically from generalizations currently advanced in domains usually regarded as unquestionably respectable subdivisions of natural science--for example, in the study of turbulence phenomena and in embryology. (p. 449).

Another cluster of objections rises from the subjective nature of the subject matter of the social sciences:

1. The subject matter is shot through with human feeling and thought which are inherently subjective. Social facts are, therefore, no more than some individual's way of perceiving a situation. Social science, therefore, cannot lay claim to the value-free objectivity properly associated with science, especially the natural sciences.

The attempts to objectify the subjective inner side of human life can take the form of art or the form of discursive knowledge. In art the objectification is accomplished by presenting in a sensuous image the artist's feeling about something.[25] In knowledge some structure of content is represented by a set of symbols combined into propositions and arguments.

In neither case does the objectification restrict itself to reporting the fact that X has this experience now. To art the import of the singular experience is the reason for its being art and constitutes its significance. The having of an experience does not tell us what it has in common with other experiences, but this does not in principle rule out the possibility of inquiring into these similarities and in making generalizations about them. Those who argue that only an imaginative identification with inner experience is possible implicitly assume that such similarities exist and are knowable.

One must agree with Nagel when he says that the ability of the social scientist

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[25]Cf. H. S. Broudy, "The Structure of Knowledge in the Arts," in Education and the Structure of Knowledge, Stanley Elam, ed., Chicago: Rand McNally, 1964, pp. 75-119.

> to enter into relations of empathy with the human actors in some social process may indeed be heuristically important in his efforts to invent suitable hypotheses which will explain the process. Nevertheless, his empathic identification with these individuals does not, by itself, constitute knowledge. (p. 484)

In other words, we don't have to be fearful to understand why a man is afraid just as we don't have to be a molecule in motion to understand why its motions account for heat. (p. 484) Even if human action does have to be explained in humanly meaningful terms these explanations do not require different logical canons than those required for the "imputation of objective traits to things in other areas of inquiry." (p. 481)

Yet, it must be conceded and fully recognized that "who" is having an experience can be more important in economics than in geology. Thus a banker's views on the state of the economy is not to be equated with just anybody's views on the matter. The banker's status becomes part of the social data in a sense that the geologist's views about geology do not become part of the geological data.

2. The value factors in both the investigator and the phenomena under investigation are so prominent in the social sciences that objectivity is impossible and therefore unanimity as to facts and theories cannot be expected.

This objection is based not only on the subjective nature of inner experience, but also on the contention that all value judgments are relative to the culture or even to a group within a culture, and the even stronger claim that all knowledge is ideology, that is, biased by the value system of an age or a culture.[26]

These objections mean that social scientists have to be especially sensitive to the normative components of their data and investigators, so much so that they themselves become important variables. For example, in current studies on the education of the culturally deprived child, it is generally recognized that a middle-class value bias may be operating and this, once known, can be taken into account. However, in order to know that this bias operates one has to compare the middle class system with value systems of other social classes. This is quite possible, but having done so, we are faced with the operational necessity of saying something about the value schema the school ought to be embodying. It is at this level that the work of the social scientist as scientist becomes of doubtful help.

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[26]For the sociology of knowledge see Karl Mannheim Ideology and Utopia, New York: Harcourt, Brace and World, 1959.

A theory of cultural relativity if pushed to the extreme, it seems to me, makes all science impossible not merely social science. For if a cultural perspective is inevitable and distortional, truth is, in principle, unattainable. If some perspectives are better than others, there must be a criterion independent of these perspectives by which better and worse are judged. Even to note that two perspectives are different requires some way of making this judgment stand up, and if we can transcend any given two perspectives, in principle we ought to be able to transcend all perspectives. If the sociology of knowledge is itself a correct theory, then it is so not by virtue of the theory of the sociology of knowledge; it must appeal to another criterion.

A third type of objection is related to the ability of disability of the social sciences to generate theories that permit fruitful explanation and prediction.

Some of the difficulties in this direction have already been discussed. Commenting on the increased complexity in the conceptual apparatus of group dynamics research Murray Horwitz notes that we have to take into account the effects of variables in the individual system on the group system and the institutional system, and that of the group system on the individual and institutional systems, and the institutional system on the group and individual systems.

> The variables within and among systems are all interdependent in the sense that variation within any cell may affect variables in the same or other cells. Indeed, a given change may result in chains of significant effects running through several cells of the matrix. This may be illustrated by a consideration of possible consequences of introducing "action research" procedures into a group or institution. As these procedures have been developed in the case of training groups and community self-surveys they entail the introduction of at least three functional roles: fact finding, feedback, and evaluation. Such a change in functional roles may produce effects within the power structure of the group...If evaluation is shared by the group, it enables wider participation in decision making and will result, presumably, in greater motivation of individual members. The practice of fact finding so far as it concerns other groups in the environment may engender hostility toward the fact-finding group...[27]

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[27]"The Conceptual Status of Group Dynamics" in Bennis, Benne, Chin, op. cit, pp. 285-286.

Yet by the use of careful statistical techniques it is possible to identify basic relationships among some of the variables, e.g., between class membership and such behaviors as voting, spending, and religious activities; these do go beyond the deliverances of common sense.[28]

However, it takes an amazing amount of evidence to discourage certain styles of inquiry. For example,

> even though there is a vast body of research on the relation of teacher characteristics to effectiveness of teaching, the reviews of this research shows no consistent relation between any characteristics, including intelligence, and such teaching effectiveness.[29]

Whether we like it or not, we cannot controvert the fact that social engineering goes on all about us, and that much of it is based on predictions from generalizations furnished by the social scientists in the form of market research, opinion polls, and the like. In principle, therefore, social science cannot be precluded a priori from coming up with important generalizations and theories.

Because of its human subject matter, most of the explanations in the social sciences tend to be functional. An event or object is explained functionally when its role or contribution to the maintenance of some system is exhibited. Two types of functionalism have been distinguished; one in which the object contributes something to a process without any conscious intent on the agent having anything to do with the process, e.g., the function of the heart. The other (teleological) does define function in terms of goals and purposes of conscious agents. It is important in functional explanations to be able to specify clearly the different states of a system and what it means to maintain them. If a system has numerous variables and the variables have indefinite potential values, and if they are all interrelated, the explanatory value disappears psychologically, and logically the theory becomes suspect because

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[28]Berelson and Steiner, op. cit., pp. 394-395.

[29]Orville G. Brim, Jr., Sociology and the Field of Education, Russell Sage Foundation, 1958, p. 32; cited in Berelson and Steiner, op. cit., p. 441. The persistence of the search for this will-of-the-wisp reflects the failure to ask why this work is so unproductive. The answer, or at least one answer, is that good teaching is not a unitary concept and cannot be made so without trivalizing the results.

some of these variables and constructs are probably ad hoc inventions and not supported by evidence apart from the phenomena under scrutiny.

Aside from the complexity problem in functional explanations, Nagel reminds us that

> ...it is hardly possible to overestimate the importance for the social sciences of recognizing that the imputation of a teleological function to a given variable must always be relative to some particular state in some particular system, and that, although a given form of social behavior may be functional for certain social attributes, it may also by dysfunctional (or even nonfunctional, in the sense of being causally irrelevant) for many others.[30]

General theories of society

A larger question is whether we can generate higher order explanations in the form of theories about social change in general. The theories of Max Weber, Emile Durkheim, Arnold Toynbee, Karl Marx are among the better known attempts in this field. These theories have from a scientific point of view not been satisfactory. Single factor theories are easily dismissed in the face of numerous counter examples. Where theories have yielded predictions, the events often did not fall out as predicted, e.g., the incidence of the proleterian revolution in Russia. If one multiplies the factors, the theories become very complicated, and it is hard to tell what is and what is not implied by them.

There are many issues involved here, but I would like to discuss only two: How precise must the predictions of a social theory be in order to have scientific value? and Must social theories be statable in the categories of individual psychology or can they be stated in terms of sociological categories in terms of the behavior of groups?

Hayek has argued that in some phenomena there are many variables some of what we have not yet identified, some of which we cannot directly observe so that predictions within a narrow range of space, time, or degree cannot be expected. Nevertheless

> ...Any statement about what we will find or not find within a stated temporal and spatial interval is a prediction and may be exceedingly useful: the information that I will find no

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[30] The Structure of Science, p. 532

> water in a certain journey may indeed be more important than the most positive statements about what I will find.[31]

He goes on to cite the doctrine of evolution as an example of a theory that

> ...will explain or predict kinds of phenomena, defined by general characteristics: the occurrence, not a narrowly defined time and place but within a wide range, of changes of certain types; or rather the absence of other types of changes in the structure of the succeeding organisms.[32]

Of course, we should keep in mind the difference between the criticism that theories of social change have not been accurate predictors, and that which holds that in principle such theories are not verifiable or falsifiable. On either approach, it is hard to decide whether in principle we can define the precise changes that such broad theories imply and the boundaries of the states of the system by which the changes could be observed and estimated. Perhaps the conservative estimate of the situation is to say that cosmic theories of social change are premature until well-established generalizations about changes within much smaller sub-systems of society are achieved, and these we have not yet achieved.

The second point has to do with the argument that since the data of the social sciences are compounded out of the actions of individual human beings, they should be explained by the "motivationally meaningful" categories of human experience. This view has been referred to as interpretive social science (Verstehende Soziologie)[33] and "methodological individualism."[34]

Hayek says that

> ...the objects of economic activity cannot be defined in objective terms but only with reference to a human purpose goes without saying. Neither a "commodity" or an "economic good," nor "food" or "money," can be defined in physical terms but only in terms of views people hold about things...

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[31] F. A. Hayek, "Degrees of Explanation," British Journal for Philosophy of Science, 6:23, Novenber 1955, p. 216.

[32] Ibid., p. 220.

[33] Ludwig von Mises, Theory and History, New Haven: Yale University Press, 1957, p. 258.

[34] F. A. Hayek, The Counter-Revolution in Science, Glencoe, Ill.: The Free Press, 1955, Chapters 4 & 6.

> Unless we can understand what the acting people mean by their actions any attempt to explain them, i.e., to subsume them under rules which connect similar situations with similar actions, are bound to fail.[35]

Furthermore:

> The structure of men's minds, the common principle on which they classify external events, provide us with the knowledge of the recurrent elements of which different social structures are built up and in terms of which we can along describe and explain them...[36]

A good part of the argument for interpretive social science also rests on the contention that the various collective terms such as "society" "economic system" "the German spirit" are not observable entities but constructs. Either they refer to a collection of individuals or to something over and above these individuals, in which case they refer to fictions.

Hayek's emphasis on psychological categories and the abstention from hypostasizing the actions of individual men into collective entities in their own right are in themselves salutary. First, they constitute a warning against too easily adopting mechanical models for the interpretation of human phenomena. Inasmuch as most machines are abstractive extensions of the human being's actions, (e.g., the rake, the plow, the lever, etc.), it is no great wonder that there will be similarities between men and machines, between human brains and computers. When men's values and other psychological activities are important variables--and in social action they almost always are--the machine from which such activities have deliberately been abstracted may no longer serve as a safe analogue for predicting what men will do. The eagerness with which educational researchers are snatching at all sorts of non-human models to find out what human beings will do is precisely what methodological individualism should alert us to and perhaps against.

The other salutary effect is to warn against hypostatization. There is a difference between the statements: "The population of Germany is growing at the rate of so and so," and "The spirit of the German State demands that only Aryans hold citizenship in it." The first statement merely indicates that for certain purposes the people of Germany need not be treated as individual persons. Similarly, the statements about the coal production of the English mines or the gross national product are not hypostatizations in any bad sense. They refer to identifiable entities, and relations among

[35] op. cit, p. 31.

[36] Ibid., pp. 33-4.

such entities can be studied with a profit.

The second kind of statement can be mischievous in that it may be used as a vector in social policy and can be used to sanction actions that individuals would not sanction, e.g., the doings at the German concentration camps. The German spirit refers to an indeterminate feeling in the minds of some men in some moods; to base decisions or a science upon it is dangerous indeed.

In the light of all the foregoing remarks and before summarizing the criteria which seem to deserve special statements for the theoretical adequacy of the conceptual framework for studying social change, I would like to indicate two lines of scientific activity that might be of profit to the field at this state of its development.

1. One can try to extrapolate existing trends in the social sub-systems represented by nations, industry, schools, government, and the like. Social science, it seems to me, can identify such trends as automation and urbanization, and it can speculate carefully as to what the consequences might look like, if these trends continue up to a stipulated time. Many of the studies already done might be collated and unified for such a purpose; the extrapolated expectations could be guides to research and plans for verifying predictions. Inasmuch as there will be no unanimity in the inferences about the consequences of present trends, there will be an opportunity for controversy and mutual criticism. This should improve the logical cogency and precision with which hypotheses in the social sciences are formulated.

2. There is a sense in which the research task in education can be divided, if we take Karl Popper's distinction between discovery and testing seriously. It is difficult, perhaps impossible, to teach people how to make scientific discoveries, but it may be possible to teach a good many people how to criticize what has been discovered.

One can learn how to deduce from a given theory (a) its logical implications and to examine them for consistency with each other and with other theories. (b) One can also learn to decide whether this is a theory that sketches relations among meanings and therefore asserts nothing about the existential world or whether it does have empirical consequences, and (c) one can look for experiments or experiment-like inquiries to test the theory, especially tests that would falsify it is the final step.[37]

I am taken by this position because whatever theoretical difficulties Popper's views on induction may entail, there can be no quarrel with its

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[37]Karl Popper, The Logic of Scientific Discovery, New York: Basic Books, 1959, first published in German 1934, Chapter I.

programmatic implications for so young a venture as educational research. Waiting for individual researchers to evolve theories from patient piling up of cases in order to arrive at generalizations is a fairly futile affair. In any case it is not the way the major advances in science are made, at least not in its early stages.

When a discipline is well-established, many new theories are sloughed off because the backlog of tested theory has a presumption of rightness. Consistency with established theory is therefore a crucial criterion. It takes a revolution in science to disturb this backlog and even then old theories are not so much destroyed as re-interpreted.[38]

This is not the case in a field where not very much is well-established; where no agreed upon body of concepts and theory exists, and where there is no long history of testing and refutation.

It may well be, therefore, that we need a systematic search for facts that would confirm or falsify some of the theories that are cluttering up the research scene. These facts will, in turn, become the crucial ones, the important variables on which further research is to be done on which new theories will be invented.

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[38]Thomas Kuhn, "Historical Structure of Scientific Discovery," Science, 136:3518, June 1, 1962, 760-4.

III. SUMMARY OF CRITERIA

This long and rambling discussion has tried to touch on so many aspects of the problem of theoretical criteria. A number of such criteria were inferred from the work in the philosophy of science and the nature of social science. Although no attempt will be made to comb the discussion for all of these criteria, I believe that the following questions may be of some help to those who are charged with formulating the strategy of the project.

1.0 How precise is the terminology?

1.1 Does a given concept or term used in a study conform to an accepted use of the term by the experts in the field?

1.2 If a different meaning from the accepted one is intended, has the difference been clearly indicated?

1.3 If a difference in meaning is intended, have reasons for the innovation been stated?

1.4 Is the "concept" being used in a psychological or a logical sense?

1.5 Have the usual logical criteria for definitions of terms been observed?

2.0 Is the given term or terms a name for a set of observational data (e.g., attitudes = answers on an attitude inventory), or is it a construct for which meanings have been stipulated (e.g., id, repression)?

2.1 If they are names of observational data, have the connotation and extension of the terms been made explicit?

2.2 If the terms are constructs, have operational definitions been given that will enable them to be translated into experimental or observational procedures?

2.3 Is the set of constructs sufficient to explain the phenomena?

2.4 Are all the constructs in the set necessary? Can some be deduced from other members of the set?

2.5 Are the concepts and constructs taken from one system of ideas (psychology) or from more than one?

2.6 If the concepts are mixed, what are the logical relations between them?

3.0 Does a theory meet logical and methodological tests?

3.1 Is there support for the theory apart from the data it was designed to explain?

3.11 Is the reasoning in it circular?

3.12 Does it beg the question?

3.13 Does it <u>name</u> the explicanda or does it <u>explain</u> them?

3.2 Have rival theories been sought out and matched for adequacy?

3.3 Have the condequences of the theory been deduced?

3.31 Are they testable?

3.32 Have they been tested?

3.33 Have the really hard cases been explained?

3.4 Has the testing been confined to finding confirmatory cases, or has there been a genuine attempt at testing that might refute the theory?

3.5 Have the generalizations in the study been over-generalized?

3.6 Does the theory lend itself to being vizualized by a model more concrete than the theory itself?

3.7 Does the model seem to fit the phenomena to which the theory refers without gross discrepancies?

3.8 Is the "theory" any more than a model borrowed from some other field?

3.9 Have the similarities and differences between the model and the phenomena been carefully scrutinized?

3.91 Are the similarities numerous and important?

3.92 Are the differences irrelevant?

4.0 To what extent have the limitations of social inquiry as a science been made explicit in this inquiry?

4.1 Is the hypothesis or theory much more complicated than the rivals in the field? Is it so complicated that even trained workers in the field cannot understand it?

4.2 Does this theory assert that everything is related to everything else, so that nothing can be separated or distinguished?

4.3 Does the theory or inquiry assume that knowledge in this type of inquiry is impossible?

4.4 Have steps been taken to identify the idiosyncratic factors in the inquiry and the cultural factors?

4.5 Have provisions been made for estimating the effects of idiosyncratic factors?

4.6 If the explanation is a functional one, have the boundaries of the system in which the variables function been clearly indicated?

4.7 Have the value assumptions of the inquiry been made explicit?